Analysis of CO Emission in Comet C/2002 T7 (LINEAR) from Infrared Observations

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Cometary nuclei are the most primitive remnants of the early Solar System. Their physical and chemical attributes allow a glimpse into the conditions in which icy bodies formed. Only in recent years has it been possible to routinely study parent volatiles in the infrared. A significant variation in composition among ten comets sampled to date has been demonstrated, and this forms the foundation of a new cometary taxonomy based on chemistry.

In spring 2004, we observed comet C/2002 T7 (LINEAR) using the facility echelle spectrometer (CSHELL) at the NASA Infrared Telescope Facility on Mauna Kea, Hawaii. CSHELL offers seeing-limited spatial resolution and sufficiently high spectral resolving power ($R \sim 2.5 \times 10^4$) to permit line-by-line intensities to be measured along its 30 arcsecond-long slit. Emission lines from multiple molecular species were targeted in the 3 to 5 micron infrared region, and our observations revealed an extremely rich chemistry in comet T7. Here we present production rates, mixing ratios, and rotational temperatures for CO spanning UT 3 - 9 May 2004, based on preliminary analysis of lines in the R and P branches of the $v = 1 – 0$ fundamental ro-vibrational band near 4.7 microns. Through comparison with abundances of other oxygen-bearing molecules, specifically formaldehyde (H_2CO) and methyl alcohol (CH_3OH), potential implications for the comet's volatile carbon-oxygen history will be discussed. The prospective of laboratory ice irradiation experimentation, as a comparative method to cometary observations, will also be explored.

This research is supported by the NASA Planetary Astronomy Program, through RTOP 344-32-98 and 344-32-51 to M. A. DiSanti.